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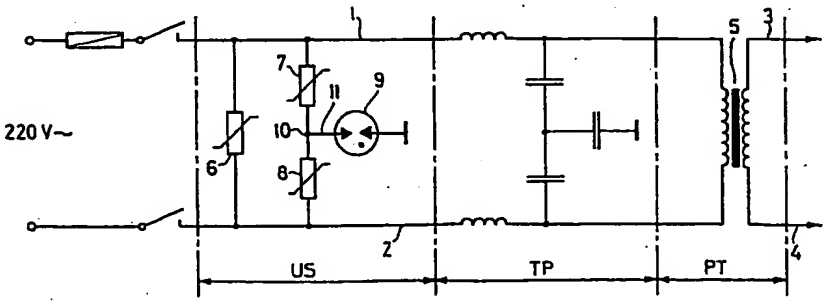
(54) Overvoltage protection device

(57) A first voltage dependent resistor 6 is connected between the two leads 1, 2 of the supply input of an electronic apparatus and each of the two leads 1, 2 is connected to ground or earth through another voltage dependent resistor 7, 8 and a gas filled overvoltage diverter 9 is arranged between the ground or earth and the other voltage dependent resistors 7, 8.

The overvoltage protection device (US) ensures a high insulation level, maintenance of the required operating voltage in the event of a trouble incidence and a suppression of the secondary current after the overvoltage has died down.



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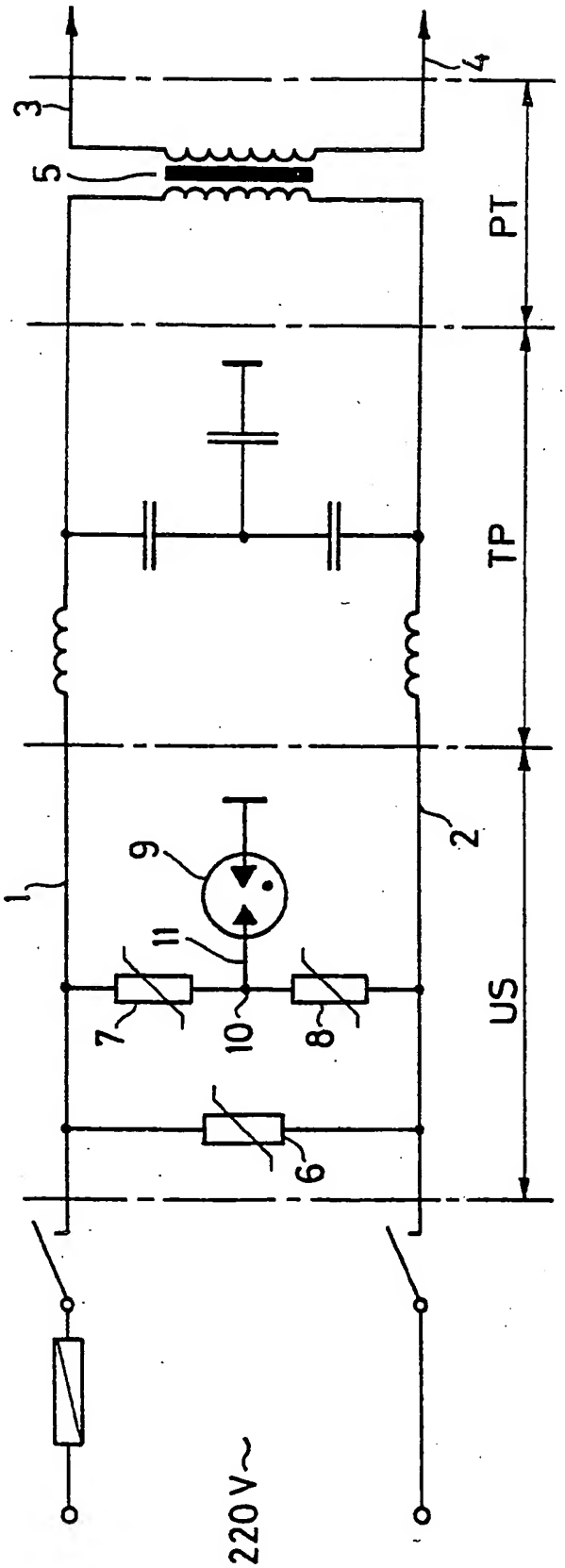

SPECIFICATION

Overvoltage protection device for electrical installations, in particular for electronic apparatus

This invention relates to an overvoltage protection device for electric installations, in particular for electronic apparatus, in which a first voltage dependent resistor is connected between the two leads of the supply input and each of these two leads is connected to ground or earth through another voltage dependent resistor.

It is well known that electronic apparatus and electric low voltage installations, i.e. installations having a nominal or operating voltage of up to about 1000 V, are at risk from overvoltages. These have their origin in, for example, atmospheric or nuclear discharges direct contacts, capacitive or inductive coupling with other electric installations carrying higher voltages, or switching processes in the low voltage installations themselves.

The use of voltage dependent resistors for overvoltage protection devices is known. Such resistors, in particular varistors, i.e. resistors in which the resistance has a negative voltage exponent, are distinguished by the fact that their resistance decreases with increasing voltage. They are therefore particularly suitable for protecting against overvoltages.

The above mentioned characteristic of voltage dependent resistors is also utilized in an overvoltage protection device of the type mentioned above disclosed in DE-OS 3,109,883 which has, however, the disadvantage that the required insulation level, for example, of at least 2 kV, is not assured since the voltage dependent resistors are directly connected to ground or earth.

The invention is provided to improve this known overvoltage protection device in that it ensures the suppression of high energy overvoltages as well as ensuring a high insulation level. At the same time, it is intended to ensure that in the event of a mishap, the operating voltage of the electronic apparatus will not fall below the level necessary for maintaining the functional efficiency of the apparatus.

This problem is solved according to the invention by the arrangement of a gas filled overvoltage diverter between the aforesaid other voltage dependent resistors and ground or earth.

The use of gas filled overvoltage diverters in overvoltage protection devices is known per se. Thus, for example, DE-AS 2,355,421 and DE-OS 2,538,919 each describes an overvoltage protection device with a gas filled overvoltage diverter and a voltage dependent resistor connected in parallel thereto. These arrangements, however, are not capable of solving the problems set out above, since as soon as the gas filled overvoltage diverter has responded, the operating voltage breaks down to its so-called arc maintenance voltage, which is about 10 to 25V. This means that in all apparatus requiring higher operating voltages, the voltage is interrupted due to short-circuiting with melting of the fuse, which puts the apparatus out of action.

Another major advantage of the overvoltage protection device according to the invention lies in the suppression of secondary currents. This means that when the overvoltage has died down, the gas filled overvoltage diverter does not, as in most known devices, continue to burn so longe as the voltage applied exceeds the necessary maintenance voltage or the excess current protection responds but is extinguished due to the action of the two additional voltage dependent resistors.

The invention will now be described in more detail with reference to an exemplary embodiment illustrated in the single figure which is a schematic circuit diagram of an overvoltage protection device according to the invention.

The supply input of an electronic apparatus which is to be protected against overvoltage is shown in the figure. The supply voltage amounting, for example, to 220 V, is applied to two supply leads 1 and 2 and the supply input is composed of three stages, as illustrated: An overvoltage protection device US, a low pass filter TP and a stage PT for potential separation, from which leads 3 and 4 branch off to the consuming device.

Stage PT for potential separation, which, as illustrated, has an inductively acting transformer 5, is assumed to be common knowledge and will therefor not be further described here. Although the low pass filter TP which is installed for reasons of electromagnetic compatability assists the protective action of the overvoltage protection device US by reducing the high frequency resdues of the overvoltage peaks, its contribution to the protective action is only of secondary importance.

The overvoltage protection device US consists, as illustrated, of a total of three ZNR resistors 6, 7 and 8 and a gas filled cell 9. The first ZNR resistor 6 is connected between the two supply leads 1 and 2. The two additional ZNR resistors 7 and 8 are connected into a second branch which connects the two supply leads 1 and 2 from which another lead 11 is branched off at the junction 10 between the two resistors 7 and 8 to be earthed or connected to ground by way of the gas filled cell 9.

The overvoltage protection device US is effective against both types of overvoltages, i.e. both those which act in phase opposition against the terminal and zero conductor and those which act in phase synchronism on terminal and zero conductor with respect to ground.

Phase opposition overvoltages are conducted away through the resistor 6 which becomes conductive, as in a bipolar Zener diode, when the overvoltage exceeds the value of its threshold voltage.

A phase synchronism overvoltage causes the gas filled cell 9 to ignite and current is therefore conducted away to earth through the resistors 7 and 8. As soon as the overvoltage has died down, the gas filled cell 9 becomes extinguished because the resistors 7 and 8 are no longer conductive at the then prevailing operating voltage of the supply network and the arc in the gas filled cell 9 therefore breaks down due to the lack of current. Due to the gas filled cell 9 being connected in series with the resistors 7 and 8, no secondary current can occur in spite of the slight maintenance voltage of the gas filled cell 9.

The following are typical values for the ZNR

resistors 6, 7 and 8 and the gas filled cell 9:
- Resistors 6, 7, 8: Threshold voltage 470 V/1ma
- Gas filled cell 9: Ignition voltage 1500 V
  Maintenance voltage 15 V.

The overvoltage protection device US described above may be used both for apparatus with protective earthing – insulation 2 kV_{eff} – and for those with protective insulation – 4 kV_{eff}. To test the insulation, all that is necessary is to remove the gas filled cell 9.

CLAIMS

1. Overvoltage protection device for electric installations, in particular for electronic apparatus, in which a first voltage-dependent resistor is connected between the two leads of the supply input and these two leads are connected to ground or earth through another voltage-dependent resistor, wherein a gas filled overvoltage diverter is arranged between said other voltage-dependent resistors and ground or earth.

2. Overvoltage protection device according to claim 1, wherein the voltage dependent resistors are formed by ZNR resistors.

3. Overvoltage protection device according to claim 2, wherein the ZNR resistors have a threshold voltage of about 470 V/1 ma and in that the gas filled overvoltage diverter has an ignition voltage of about 1500 V and a maintenance voltage of about 15 V.

4. Overvoltage protection device substantially as herein described and as illustrated in the accompanying drawing.

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